000231

CG 159

DELUXE COLOR GENERATOR

SENCORE

SENCORE SERVICE MANUAL

3200 SENCORE DRIVE, SIOUX FALLS, FALLS, SOUTH DAKOTA 57107

SAFETY PRECAUTIONS

When testing electronic equipment, there is always a danger present. Unexpected high voltages can be present at unusual locations in defective equipment. The technician should become familiar with the device that he is working on and observe the following precautions.

1. An isolation transformer should always be used on equipment having the chassis tied to one side of the AC power line.

2. When making test lead connections to high voltage points, remove the power, if this cannot be done, be sure to avoid contact with other equipment or metal objects. Place one hand in you pocket as a safety precaution and stand on an insulated floor to reduce the possibility of shock.

3. Discharge filter capacitors before connecting test leads to them. Capacitors can store a charge that could be dangerous to the technician.

4. Be sure your equipment is in good order. Broken or frayed test leads can be extremely dangerous and can expose the technician to dangerous potentials.

5. Remove the test leads immediately after the test has been completed to reduce the possibility of shock.

6. Do not work alone when working on hazardous circuits. Always have another person close by in case of accident. Remember, even a minor shock can be the cause of a more serious accident, such as falling against the equipment, or coming in contact with higher voltages.

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OPERATING INSTRUCTIONS
FOR THE SENCORE CG159
COLOR KING III DELUXE COLOR GENERATOR

DESCRIPTION

The new King in color bar generators, the CG159 is the result of an never ending search for better products for the electronic maintenance industry. Sencore engineers have devised even more stable circuits than ever before was obtainable with simplicity in mind for greater dependability in operation. The new Perma Lock circuits along with the exclusive thermostatically controlled temperature control make the Color King III the generator for daily use in all kinds of weather and temperature extremes.

The Dot size is adjustable from the front panel of the Color King and the RF channel selection switch covers the entire low VHF band, channel 2 to channel 6.

Here are the seven standard patterns provided by the Color King generator.

Ten Standard Color Bars: The type and phase that has now become the standard in the industry. Crystal controlled keyed bars (with 30 degree phase change between each) as explained in almost all service literature and magazines, offers a complete gamut of colors for every color circuit test.

Adjustable Size White Dots: New stabilized dots, a must for static convergence, are created by the all new Sencore counting circuits. The dot size is adjustable from the front of the unit.

Crosshatch Pattern: The basic convergence pattern. Also used for overscan and linearity adjustments on the TV receiver.

Vertical and Horizontal Bars: An added feature to help speed up dynamic convergence.

Single Line Crosshatch Pattern: Faster convergence is possible with single vertical and horizontal lines that can be moved anywhere on the screen.

Single Dot Pattern: Single dot for fast DC convergence at center of screen.

SPECIFICATIONS

RF Output: Front panel switching of any low band channel 2 - 6.

Modulation: Any one of seven patterns: Color Bars, Dots, Crosshatch, Vertical Bars, Horizontal Bars, Single Crosshatch, Single Dot.

Crystal Complement: 1 - 189 KHz ± .005% for timers and 1 - 3563.795 KHz ± .001% for color bars, 1 - 4.5 MHz for sound carrier.

Semiconductor Complement: 14 - 2N5172, 4 - 2N4248, 1 - 2N5227, 5 - 1N34A, 2 - 1M695, 1 - 12 Volt zener diode and 1 - 8 volt zener diode.

Power: 105 - 125 VAC 50/60 Hertz, 30 watts

Size: 10-1/4 x 9-1/2 x 4 inches

Net Weight: 9 pounds

OPERATION

CONTROLS ON THE COLOR KING

The Color King has three main controls. The TV CHANNEL selector switch, the PATTERN switch and the COLOR OUTPUT control. There are three subcontrols, the 4.5 MHz sound carrier switch and the VERT CTR and HORIZ CTR controls for the single line and dot patterns. The dot size adjustment and the timer adjustments are also available as secondary controls near the bottom of the panel.

The TEMP CONTROL light is a heating element automatically controlled with a thermostat for cold weather operation.

Pattern Switch: The Pattern switch selects one of the seven patterns available. Composite sync is fed to the modulator at all times, so that the patterns will not jump or fall out of sync, when switching from one pattern to another. The following patterns are available on the Color King.

1. Dots: There are 117 small size dots that are adjustable in size, primarily for DC convergence. A color TV set, that is properly converged, will have white dots in the center of the screen (all three guns hitting the same spot on the CRT). Static or DC convergence is controlled by three small magnets, spaced at 120 degrees around the neck of the CRT, plus the blue lateral positioning magnet.

2. Single Dot: A single dot with adjustable position is provided for easiest DC convergence possible - only one dot to look at.

3. Crosshatch: In the crosshatch position, 9 vertical and 13 horizontal lines are visible on the CRT screen. The crosshatch pattern is used for dynamic convergence adjustments, over scan adjustments (height and width) and for linearity adjustments.

4. Single Crosshatch: A single crosshatch, each line position adjustable, is provided for easiest dynamic convergence possible - one line prevents confusion. Also used for centering purity ring magnets when adjust purity.

5. Vertical Bars: 9 vertical bars are visible in the vertical bar position. These are primarily used when adjusting the dynamic vertical convergence.

6. Horizontal Bars: 13 horizontal bars are visible on the TV screen, when in the horizontal bar position. These are primarily used for the horizontal dynamic convergence.

7. Ten Color Bars: 10 color bars are generated for color alignment and trouble-shooting in the color circuits of the TV receiver. The color output is controlled with a separate control. The colors which will be displayed on a normal set are shown on the pattern indicating strip on front panel.

Color Output Control: The color output control changes the amount of color signal that is fed to the modulator. It is primarily used to check the color sync abilities of the receiver. A setting of 100 percent is normal. With most receivers, the control can be turned to almost 0 percent before the set will lose color sync. This is indicated by diagonal bands of color (barber pole effect) within each color bar. The 200 percent setting of the control is used to force a defective set to sync while trouble-shooting.

TV Channel Selector: The TV channel selector will select any low band channel 2-6 for signal insertion. In use the switch should be set to any unused channel in an area.

Vertical Line: The vertical line control moves the vertical line in the single crosshatch pattern to the left or right or moves the single dot to the left or right.

Horizontal Line: The horizontal line control moves the horizontal line in the single crosshatch pattern up or down or moves the single dot up or down.

Power Switch: The power switch is used to turn the unit ON. Even though the Color King is completely solid state, it will take about 3 seconds for the patterns to completely stabilize on the screen of the TV receiver.

Sound Carrier: The sound carrier switch is used to insert the 4.5 megahertz sound carrier into the RF signal from the Color King. This signal is used primarily to insure proper tuning of the TV set, but can also be used to analyze and trouble-shoot the audio circuits.

TEMP CONTROL: The TEMP CONTROL indicator tells when the heating element in the Color King is on. It should not be confused with the power indicator next to the OFF-ON switch. The TEMP CONTROL indicator will come on when the temperature inside the unit is approximately 85^{o} F or below and will shut off when the internal temperature is approximately 110^{o} F.

If the Color King is brought inside and used after being subjected to very low temperatures the TEMP CONTROL indicator will come on and stay on until the internal temperature reaches 100^{0} F, usually after several minutes. When first turned on the timers may not be stabilized, but will stabilize very rapidly once the temperature starts to rise.

The timers are factory adjusted towards the high end of the temperature range so it is almost impossible to find a temperature condition that would cause the Color King timers to become unstable.

OPERATING THE COLOR KING

To use the Color King simply turn the power switch to ON and connect the antenna lead to the antenna terminals on the TV receiver. Tune the TV set to the same channel you have the Color King tuned to. Turn the pattern switch to the desired pattern.

Sharp well-defined patterns are necessary for convergence adjustments and for trouble-shooting. Since the settings of the TV controls will affect the quality and sharpness of the patterns produced by the Color King, we will discuss briefly how these TV controls should be set. In all the following steps, the Color King is on and the output cable is connected to the TV antenna terminals, and the TV set tuned to the same channel as the Color King.

Fine Tuning: Turn the Color King to color bars and turn on the 4.5 Megahertz oscillator. Adjust the TV fine tuning control until a 920 KHz beat (herringbone pattern) is seen in the color bars. Back off the TV fine tuning control until the herringbone effect just disappears, or is at a minimum. The 4.5 Megahertz oscillator can now be turned off. This is the best tuning point for the TV and the control should be left at this setting for all of the black and white patterns also. Occasionally, however, a higher dot contrast range (dot brightness versus background) can be achieved by detuning the TV slightly to favor the dot frequency.

Contrast and Brightness Controls: Because the Color King has been designed with very little background "hash" on any of the patterns, the settings of the contrast and brightness controls can be set to your liking. However, for convergence adjustments it is desirable to have a high contrast between the pattern and the background level. In this case, the contrast should be turned to near maximum. On dots, the increase of contrast may tend to increase the size of the dot on the screen. When viewing color bars, it is sometimes desirable to eliminate the Y signal. Simply turn the contrast control to zero.

Vertical Hold: All color TV sets have vertical retrace blanking. If the vertical hold is not adjusted properly, retrace lines can be seen in the upper part of the picture Adjust the vertical hold control, for the minimum number of retrace lines, consistent with good vertical hold.

Horizontal Hold: On some sets there may be a slight "fanning" or "bending" of the vertical lines at the top of the picture. This will occur if the horizontal hold control is not properly adjusted. These can virtually be eliminated by adjusting the horizontal hold control. A high contrast setting may also cause this effect.

APPLICATION

SETTING UP AND TROUBLE-SHOOTING WITH THE COLOR KING

Setting up and trouble-shooting color TV is easy with the Color King. In addition to a good generator, however, an established procedure should be followed so that time will not be wasted. The color set can be broken down into two catagories, that which requires setup only, usually done in the home and that which requires trouble-shooting usually done on the bench. Each catagory has a different procedure to follow to eliminate wasted time.

COLOR TV SETUP

The setup or convergence of the color TV is usually done in the home and the following procedure should be followed to eliminate wasted time:

1. Check and set the high voltage if necessary. The high voltage should be adjusted with a good high impedence meter such as a Sencore Field Effect meter for greatest accuracy.

2. Check and adjust the height and linearity. You can use the crosshatch pattern of your generator for this check.

3. Check and adjust the purity if necessary. The Color King set to color bars and the output control reduced to "0" or the blank raster is ideal for this.

4. Check the static convergence magnets. Here the single dot centered is the best pattern to use.

5. Adjust the dynamic convergence controls for the remaining parts of the screen.

If the high voltage is not set properly to begin with or the linearity or the purity is adjusted after convergence, the entire convergence procedure will have to be repeated as all of these will affect the convergence of the color TV receiver.

Let's see how this works with the following example. If a color set is tilted on it's side or even tilted up as little as 30 degrees, the purity of the CRT may go off (electron beams from each gun will hit all three colors of phosper dots instead of just their own color). Under this condition, the black and white patterns from the Color King (dots, crosshatch, etc.) will look quite presentable, and you may not be able to detect anything wrong. However, if you switch to color bars, the colors will be strange or completely gone, and your first impression would be to start analyzing the color circuits. Thus, you can see the importance of checking for proper purity and convergence first.

CHECKING AND ADJUSTING PURITY

The adjustment of purity is important, especially in the new rectangular color receivers. If the receiver has a set up switch with a purity position, this can be used. Some receivers do not have this switch or do not have a purity position. You can use the Color King to obtain a blank raster by connecting it to the antenna terminals and setting it to the Color Bar position. Rotate the COLOR OUTPUT control fully counter clockwise to the BLANK RASTER position. You will now have a clean blank raster for setting of the purity of the receiver. There are some cases where you wish to know the center of the screen for adjusting the purity magnets and the fire ball. Here you may use the single cross hatch pattern for this adjustment for precise setting of the purity rings. Follow the manufacturers procedure for setting of the purity rings and yoke for best results.

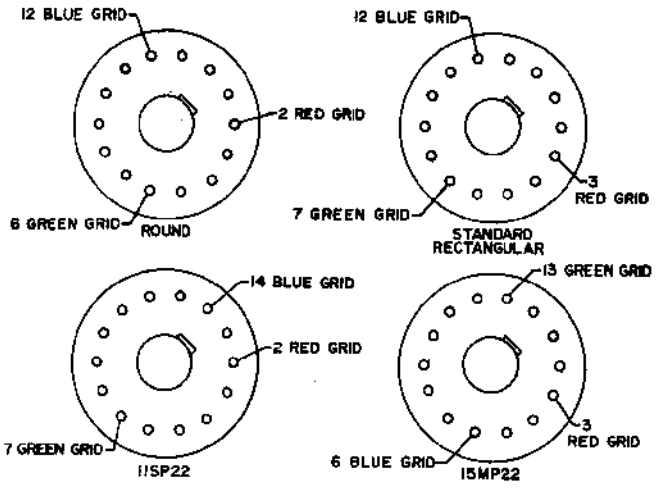

Fig. 1 - Rear View of Color tube bases

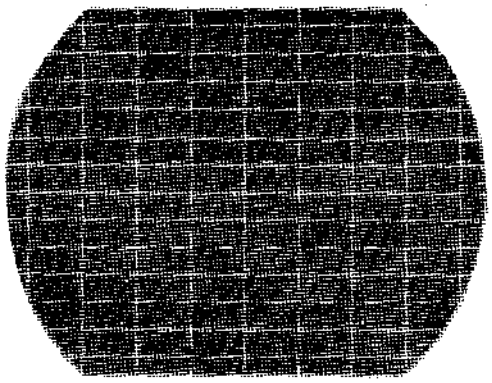

Fig. 2 - Crosshatch pattern

If purity cannot be obtained by normal adjustments, it is possible that the CRT shadow mask has become magnetized, in which case a degausing coil is needed. Move the coil around the screen of the picture tube for about one minute, and slowly move the coil straight out from the screen with the same motion, until it is about six feet away. Turn the coil at right angles to the CRT screen and turn it off. On many of the new color receivers a built in degausing coil can be found, but it is still a good practice to degause with your external coil as some of the built in coils are not effective if the screen has become magnetized by a l arge magnetic field. You will also note that on some of the newer rectangular screen color receivers, that it is a good idea to degause the screen each time you move the purity magnets to get the best purity on the screen.

CHECKING THE STATIC AND DYNAMIC CONVERGENCE

Connect the Color King to the TV and set the pattern switch to single dot. Position the dot near the center of the screen. The electron beams from all three guns should hit the CRT at the same point. If they do not, adjust the three beam positioning magnets and the blue lateral magnet until they do. This is the DC or Static convergence. NOTE: The dot must be near the center of the screen for this check.

For dynamic convergence the crosshatch, single crosshatch, and vertical and horizontal bar patterns are used. Dynamic procedures are slightly different for each color set and to make these adjustments to specifications, the service literature for the set should be followed.

After adjusting Purity and Convergence, check all of the circuits which will effect the black and white picture. These circuits, in color TV sets, do not differ appreciably from the circuits found in black and white sets, except for an additional group of controls used for black and white tracking adjustments. This group consists of separate controls for the screen voltages on each CRT gun, plus a B gain or drive, G gain or drive and CRT bias control. In older sets "background" controls took the place of the B gain and CRT bias controls.

To adjust these controls you should refer to service literature for the set, but basically the screen controls are adjusted for equal intensity of each color, whereas, the B gain or drive, G gain or drive and CRT bias controls are adjusted for the best black and white picture, throughout the normal range of the TV brightness and contrast controls.

Other slight differences in color TV circuits are a regulated high voltage supply to reduce blooming and loss of convergence, a separate focus voltage supply and a wider IF response to pass the color information.

COLOR TV TROUBLE SHOOTING

The trouble in the color TV should be isolated to the section giving the trouble in order to reduce wasted time checking other circuits that may not be at fault. If a standard procedure is followed, then much wasted time will be eliminated and service will be faster. If the trouble appears in the color circuits of the TV:

1. Check the CRT for tracking and emission with a CRT checker such as the Sencore CRT Champion. Some CRT problems can look like circuit problems and some circuit problems can look like CRT problems.

2. Check for proper black and white operation. If the black and white picture is good, then the problem is in the chroma circuits. If the black and white picture is not good, then the problem is probably in the RF or IF circuits and should be checked with a sweep generator, such as the Sencore SM152 or SM158. If the vertical lines on the cross hatch pattern of the generator appear weak and smeared, this is also an indication of poor alignment of the IF circuits. The fast rise time of the vertical line will show up the high frequency response of the TV receiver. If the IF has a good alignment curve, then a trouble in the video amplifier is indicated by the weak and smeared vertical lines.

If the problems are indicated in the chroma circuits, then a good understanding of the chroma circuits, a good color bar generator and good wide band scope are needed to find the trouble. The following is a brief description of the different circuits in the chroma section of the color TV receiver and the functions that they perform.

Bandpass Amplifier: The bandpass amplifier is used to separate and amplify, from the video signal, the band of frequencies from 3 to 4.1 megahertz. All of the transmitted color information is within this band.

3.58 Megahertz Reference Oscillator: The reference oscillator is used to restore the color carrier in the demodulator circuits of the color TV set. It is kept in phase with the original carrier at the transmitter, by controlling it with the color bursts which are on the horizontal back porch. The oscillator provides two signals separated by a 90 degree phase shift for the demodulators.

Demodulators: The demodulators beat the reference oscillator signals against the chroma signal from the bandpass amplifier to produce color signals for the CRT. In some of the newer receivers, the color gun grids are driven directly from the demodulators. In other receivers, the color signals are amplified in R-Y, B-Y, and G-Y amplifiers before being applied to the CRT grids. In the new solid state receivers, the color signals and the Y signal are both fed into the same amplifiers and then to the CRT cathode. The results are the same in all three systems.

Burst Amplifier: The burst amplifier separates and amplifies the burst pulse from the video signal to control the 3.58 megacycle reference oscillator.

Color Killer: The color killer circuit produces a negative bias, in the absence of a color signal, to cut off the band pass amplifier. It is controlled by the output of the phase detector.

Phase Detector: The phase detector compares the burst signal from the burst amplifier with the reference oscillator signal. It controls the phase of the reference oscillator signal and, also controls the color killer.

To trouble-shoot these circuits, you need the Color King set to the color bar pattern and a good wide band service oscilloscope with a low capacity probe, such as the Sencore Model PS148.

Let's start with the bandpass amplifier. Zenith uses a two stage amplifier (See Figure 3), whereas, RCA uses a single stage amplifier (See Figure 4). Waveforms (W1, W2 etc.) that you should get with the Color King are shown at each input and output of the amplifiers.

Some of the main differences between the circuits are these: (1) Zenith picks up the color input from the video detector; RCA from the first video amplifier, (2) Zenith has the burst pickoff after the signal passes through the first chroma amplifier; RCA picks off the burst at the input to the bandpass amplifier (3) the burst signal appears at the output of the Zenith amplifier, whereas, in the RCA it is gated out because of a positive gate pulse applied to the amplifier cathode, (4) Zenith has an additional feature, ACC (Automatic Color Control) applied to the grid of the first amplifier which keeps the grain of this stage constant during minor changes in the amplitude of the incoming color signal.

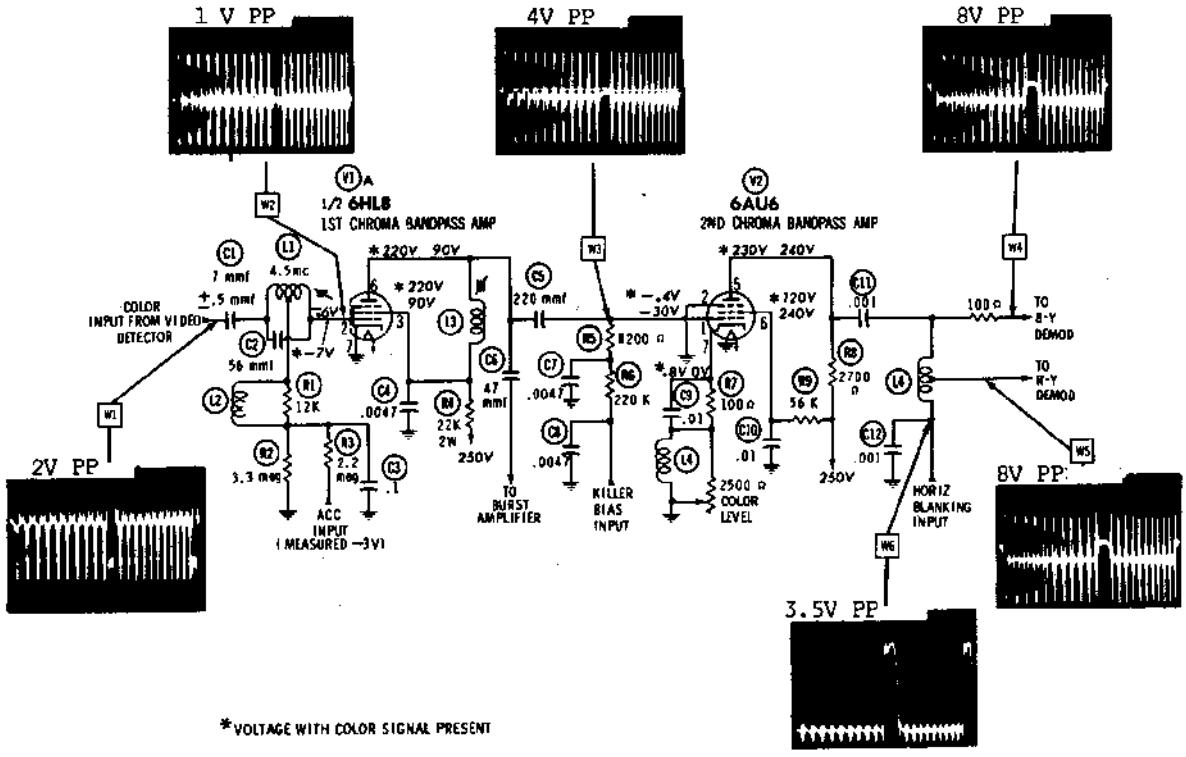

Fig. 3 - Two-stage Zenith Bandpass amplifier

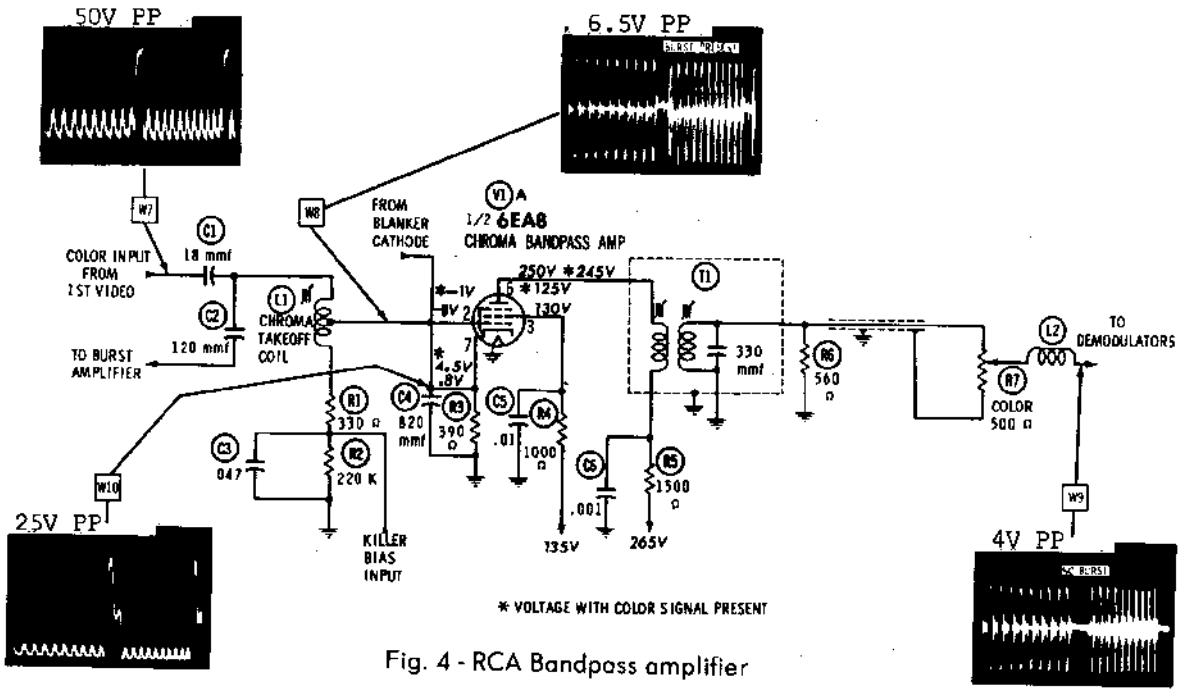

Fig. 4 - RCA Bandpass amplifier

The waveform at the plate of the burst amplifier is shown in Figure 5. This signal will exist only when color is being transmitted. If you switch the Color King to a black and white pattern, the burst will disappear, although the base line will still show traces of the horizontal gate pulse.

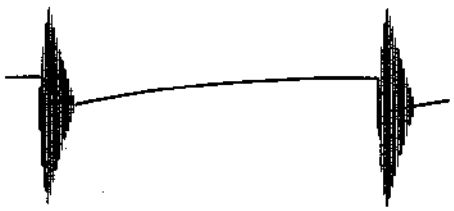

Fig. 5 - Waveform at plate of burst amplifier

Color Demodulator: The following schematic (Figure 6) is a high level type demodulator circuit, used in some of the recent color sets. In the older low level type of color demodulator, the color information was beat against the 3.58 MHz reference oscillator and then amplified in additional stages, and applied to the grids of the CRT. In the high level type, the signal from the bandpass amplifier also beats against the 3.58 MHz reference oscillator, but the resultant demodulator color signals are high in amplitude and are coupled directly to the grids of the CRT without additional amplification. The example shown here makes use of a tube having a single control grid, a single screen grid, but two supressor grids and two plates. All three CRT grid signals R-Y,

B-Y and G-Y are developed at a high amplitude. 3.58 MHz oscillator signals, 90 degrees out of phase, are fed to the supressor grids and the signals developed at the plates are the blue and red color signals. The screen grid picks up the average current flow, which is the green signal and this is applied to the green CRT grid. The waveforms are typical of those found when using the color bar pattern from the Color King.

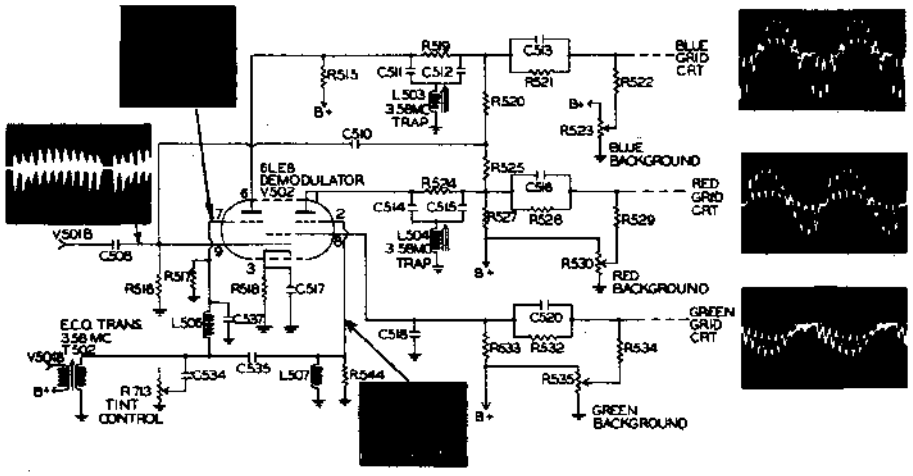

Fig. 6 - High level demodulator used in Color TV

The waveforms at the output of the 3.58 megahertz reference oscillator and the waveforms at the oscillator inputs to the demodulators are continuous 3.58 megahertz sine wave signals and are present at all times. Refer to the service literature for the amplitude of these signals. The waveforms at the output of the demodulators or at the CRT grids in those sets that use amplifiers are shown in Figure 7.

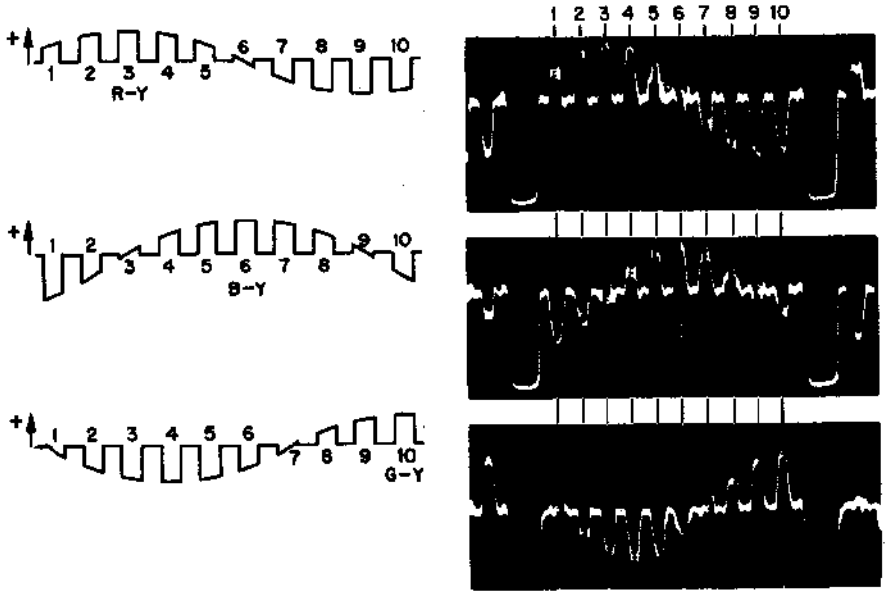

Fig. 7 - Scope displays at Red, Green and Blue CRT control grids

DEMODULATOR PHASING CHECK

The Color King can be used to quickly and easily check the demodulator phasing. Just connect the Color King to the TV set and turn to the color bar pattern. The phasing check can be made with a regular wide band scope or a vectorscope very simply.

With Scope

When using an oscilloscope to make these adjustments, proceed as above, but make CRT grid patterns identical to those shown in Figure 7.

There are several different types of demodulator systems now in use, and each requires a slightly different procedure for adjustment of proper phasing. They vary somewhat in this but the waveforms, presented to the grids of the color CRT, are always the same except for the amplitude. Almost all manufacturers use the keyed color bar pattern in the chroma circuits. Figure 9 shows the waveform produced by the color bar pattern, as it should be seen at the video detector.

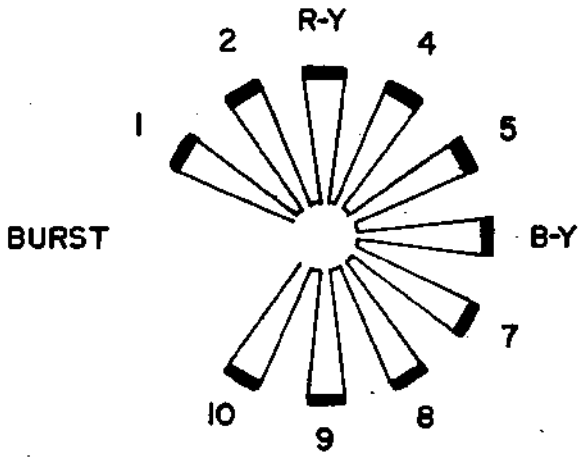

Fig. 8 - Ideal vector display on Vectorscope

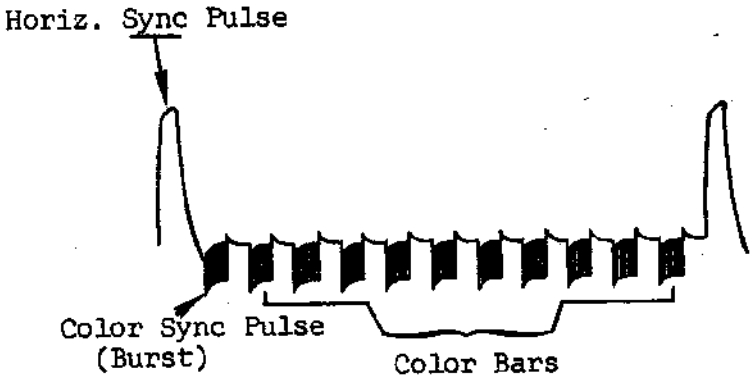

Fig. 9 - Standard color bar scope waveform found in chroma circuits

With Vectorscope

With a Vectorscope such as the Sencore PS148, the demodulator phasing as well as the other adjustments can be accomplished faster and easier because you are monitoring both the red and blue signals at the same time. To use with the vectorscope, the Color King is connected the same as in the other methods. The vectorscope is connected to the red and blue grids of the CRT and set for vectors. The pattern on the scope screen should appear as shown in Figure 8. The third bar of the vector pattern is the third bar of the color bar pattern or the red signal and the sixth bar of the vector pattern is the sixth bar of the color bar pattern and is the blue signal. With the demodulator phase adjusted properly and the tint control centered, the third bar of the vector pattern should point to the R-Y mark on the scope screen and the sixth bar to the B-Y mark. This represents an angle between the red and blue of 90 degrees as found in most of the older color receivers. If the angle is greater, and the sixth bar falls half way between the B-Y mark and the 7 mark on the scope screen, it indicates an angle of 105 degrees as found on most of the newer receivers.

DETERMINING COLOR SYNC CAPABILITIES

The color TV receiver may sync perfectly horizontally and vertically but the colors may not stay in sync. This is because the sync circuits in the Chroma section are synchronized from the 3.58 MHz color sub-carrier (back porch of horizontal sync pulse). New color TV receivers should be checked for their ability to sync when installed. Here is where the Color King is handy, as a color signal may not be present from the TV station, at the time of installation. To check color sync, after adjusting the TV set for good color bars, reduce the CHROMA setting from 100 percent to zero. The colors should stay in sync to a least the 50 percent calibration point on the control. When viewing the color bars, the colors should stay in sync as long as they are weakly visible on the CRT. If they do not stay in sync, adjustment of the color killer or burst amplifier should be made according to the instructions given in the manufacturer's service literature. If sync cannot be held, the color circuits are defective.

THE COLOR KING PRODUCES STANDARD COLOR BARS

The color bar pattern, used in the above trouble-shooting procedure, has become the standard of the industry. It is simple to use for analyzing and adjusting color TV circuits, because one pattern covers the full color range eliminating confusion and guesswork.

The principle behind this type of pattern is simple. An oscillator that is operating at a frequency of 3563795 Hertz (the color carrier frequency 3579545 Hertz minus the horizontal line frequency) will appear as a 3.58 megahertz signal that is constantly changing in phase, when compared to the 3.58 megahertz

reference oscillator signal in the TV. Thus, there is a complete change in phase of 360 degrees for each horizontal line of sweep. Therefore, a complete range of colors is produced during each horizontal line. Each line displays all colors the same since the phase difference between both oscillators at the beginning of the sweep is always zero. (If the phase changes 360 degrees during one sweep starting with zero phase difference at the beginning of the sweep, then it will also be zero at the beginning of the next sweep, etc.).

By gating the 3.56 megahertz oscillator at a frequency 12 times higher than the horizontal sweep frequency, color bars can be produced that are exactly 30 degrees apart all around the color spectrum. When viewed on the picture tube in a normal operating set, they will appear as shown in Figure 10.

Note that of the 12 gated burst only 10 show on the picture tube as color bars. This is because one of the bursts occurs at the same time as the horizontal sync pulse and thus, is eliminated. The other occurs immediately after the horizontal sync pulse and becomes the color sync burst, which is used to control the 3.58 megahertz reference oscillator in the TV set.

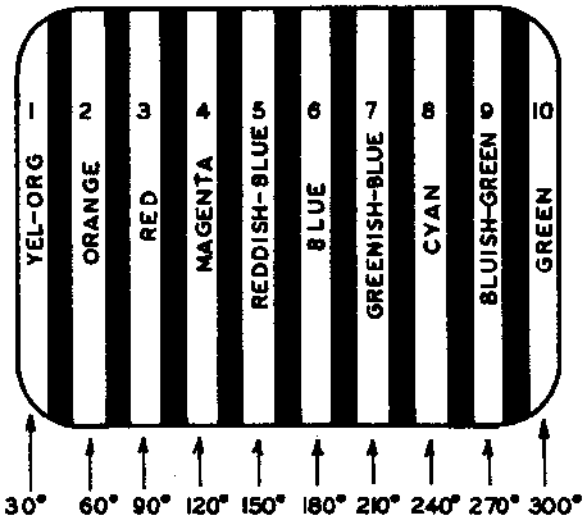

Fig. 10 - Standard color bar pattern

MAINTENANCE

DISASSEMBLY INSTRUCTIONS

To disassemble the CG159, remove the two screws at the top of the panel and the two screws on the rear of the case. The panel may now be lifted out of the case for servicing.

The PC board may be lifted by removing the six screws around the board. To get at the bottom, simply bend the board away from the top bracket. This will allow exposure to both sides of the board. The unit will be fully operational in this condition. Be careful of the heater rope. The board may be placed against the rope when servicing, and possible damage could result if the heater is on. Placing the soldering iron tip against the thermostat until it opens will keep the heater rope off and the possibility of damage down.

TIMER CONTROLS

The Color King timer system has been designed to count down from a 188.8 KHz crystal to the 15,750 and 60 Hertz sync signals needed for a stable locked pattern. The circuits are simple and have a minimum number of components so that instability and component failure will be at a minimum. The front panel controls allow you to retime the count down circuits in case of component aging. These adjustments can be made with a screwdriver from the front panel, if necessary.

The three timer controls are located on the lower right hand corner of the panel and are plainly marked.

Horiz. Hold: This is similiar to the horizontal hold control of a TV receiver is adjusted for 13 lines visable under normal conditions of proper overscan and 14 if the raster is pulled in.

Vert Stability: Controls the stability or vertical roll through of the pattern. It is adjusted for a steady pattern without any roll through or wiggle. The controls are simple and easy to adjust and should cause no problem if you know what you are looking for. It is a good idea to turn each control through its range on a working TV receiver to see its effect so that you will recognize it in the future should it occur.

TIMER ADJUSTMENT PROCEDURE

If a defective component has been replaced in one of the timer stages, you may have to reset the internal range adjust controls to recenter the front panel controls. The procedure is simple and requires only a large screen T V receiver.

Using a large screen TV receiver, either black and white or color, set the receiver to a station signal and center the horizontal and vertical hold controls.

1. Set the front panel controls to the center of their range using the screwdriver slot and the white mark on the panel as a guide.

2. Turn the Horizontal control on the PC board fully blockwise. Now turn the control back until the pattern stabilizes. Note this point. Turn the control further until the pattern losses sync again. Then back the control between this point and the first point for best range.

3. Center the Horizontal Line control and the pulse control.

4. Adjust the 60 Hertz control for the slowest pattern wiggle or roll through.

5. Adjust the horizontal line control while observing the scanning lines on the TV screen. Set this control for 16 scanning lines between horizontal lines. If the pattern has a slight movement, adjust the pulse control until this movement disappears. Note the number of scanning lines as this control has interaction with the Horizontal Line control. Center all controls as was done with the Horizontal control.

MAKING COLOR KING ADJUSTMENTS

Dot Size: The Color King dot size adjustment is accessible from the front of the unit. The dot size adjustment, C32, changes the width of the dots and vertical lines in the multiple dot, crosshatch and vertical line patterns. The smaller the dots, the more readily you can notice the error in convergence. However, the dots should not be made so small that they are difficult to see clearly. You should adjust the dot size trimmer to your own liking while observing the pattern on a TV set. After adjusting the dot size, check the vertical lines to be sure that you have not made them so small that they will not be useable.

Color Frequency: The color sub-carrier must be quite accurate. It can be adjusted, without laboratory equipment, by using the burst from a color program. Tune in a color program on an operating color set. Remove the correction voltage to the 3.58 MHz oscillator in the TV set and adjust the reference oscillator in the TV until a beat is seen in the picture, or the colors are holding sync. Connect the Color King to the set and adjust for a color pattern. With the correction voltage of 3.58 MHz oscillator in the TV set still disabled, adjust the color phase adjustment, C24, for a zero beat in the color bar pattern. For best reulsts, you should go through this procedure twice.

Single Vertical and Horizontal Lines: The single vertical and horizontal lines are adjusted with R46 and R53 so that full range of the front panel controls is realized, and also that the vertical line will not go off the right edge of the TV screen and the horizontal line will not go off the bottom of the screen.

To adjust these controls, display the single crosshatch pattern on a TV set that has a properly centered raster. Turn the VERT LINE and HORIZ LINE controls fully clockwise. Adjust R46 so that the vertical line is approximately two inches from the right edge of the screen. Adjust R53 so that the horizontal line is approximately one inch from the bottom of the screen.

RF Adjustments: The trimmers for the RF adjustments are located inside of the Color King on the top PC mounting bracket. The trimmers are marked with a label on the inside and figure 11.

The RF trimmers should seldom, if ever, needs adjustment. If adjustment is required, the following procedure may be used.

To adjust the trimmers, you may use a known good TV receiver or a field strength meter such as the Sencore FS134. Start with channel six and adjust each trimmer for best color or maximum signal at the carrier frequency on the field strength meter. After adjusting each channel recheck your adjustments. A slight interaction may be evident.

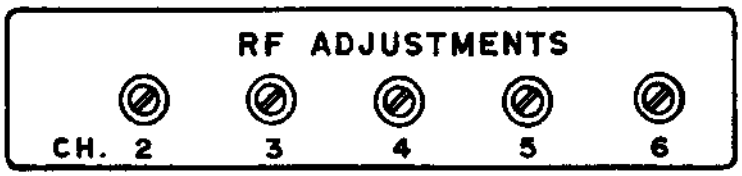

Fig. 11 - R.F. Trimmer location

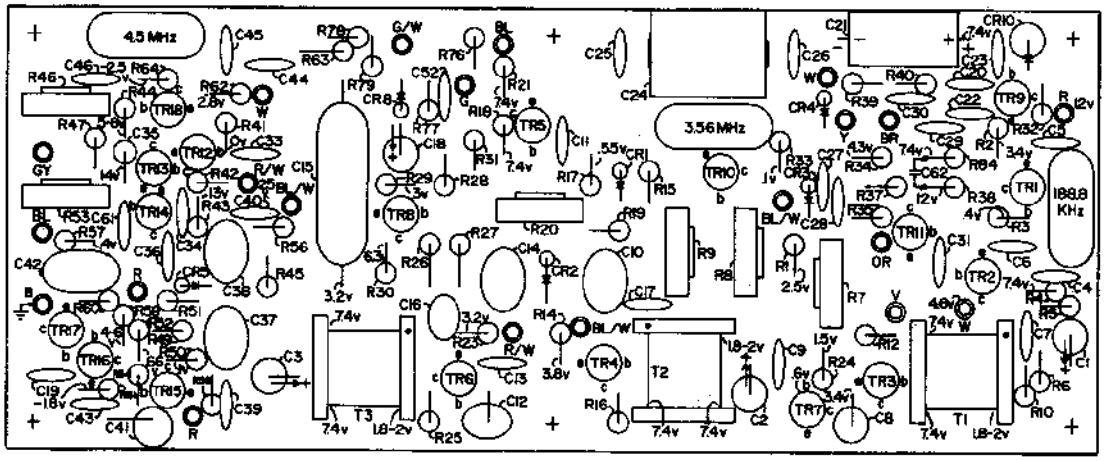

Fig. 12 - P.C. Board layout

CIRCUIT DESCRIPTION

The CG159 Color King III is basically a miniture transmitter, generating stable patterns for convergence and trouble shooting of television receivers.

The "heart" of the generator is the 188.8KHz crystal oscillator which provides the stable lock. The output of the crystal oscillator TR1 is shaped by TR3 and coupled into the count down stages of TR3, TR4, and TR5. Each of these stages operate in the same manner. The basic circuit is a blocking oscillator that is syncronized by the incoming pulses from the shaper or preceding stage. R7, R8, and R9 establish the main bias on the counting stages and the range the timers will operate at. TR7 is used as a diode for temperature compensation. The time constant for the oscillators are in the emitters and consist of R12, R11, and C8 for the horizontal oscillator; R13, R14 and C12 for the horizontal line oscillator and R22, R23 and C15 for the vertical oscillator. Each emitter is adjustable, R11, R13 and R22 as a front panel adjustment. These adjustments have a wide range and can be used for compensation of component aging.

The horizontal line oscillator is slightly different from the other two with an additional circuit or feedback loop from the vertical oscillator. CR2 and C14 form the feedback pulse and cause the normal count of 17 of the Horizontal line oscillator to change to 24 each time a vertical sync signal is generated. This feedback loop is the vertical and horizontal line oscillators provides greater stability of these circuits.

Horizontal pulses are coupled from TR3s emitter through C17 and R27 and vertical pulses from TR6 through C16 and R26 into the base of the sync shaper TR8. TR8 equalizes and shapes the sync pulses before coupling them into the clipper CR8. The same pulses from the Horizontal and vertical oscillator emitters are coupled into TR12 the trigger amp through C33 for the single vertical line and C19 to the single Horizontal line multivibrator.

Horizontal line pulses are taken from TR4s collector through a pulse stretching diode into the shaping stage TR5. The pulses are coupled from TR5s collector through R21 to the function switch.

A 188.8KHz pulse is taken from the collector of TR2 shaping stage and coupled through the front panel DOT SIZE adjustment C32 through the diode gate CR4 to form dots. The same signal from the DOT SIZE is coupled through R39 to the function switch to form the vertical lines. The same 188.8KHz signal is coupled through C31 into TR11, a shaper stage.

The TR11 shaper stage shapes the pulse and couples it into the color gate CR3. The 3.56 crystal oscillator stage TR10 generates a continuous 3.56 MHz signal that is coupled through C27 into the color gate CR3. The 3.56 MHz signal is gated on and off by the 188.8KHz pulses from TR11 creating the 10 color bar pattern that is coupled to the function switch.

The vertical line delay multivibrator and the horizontal line delay multivibrator generate the single crosshatch and the single dot patterns. The lines are controlled with R48 and R58. The horizontal line is inverted in TR15 and mixed with the vertical line in the collector circuit. The single dot signal is taken from CR5, and both signals are coupled through capacitors to the function switch.

The signals are selected for the desired pattern on the TV receiver screen and coupled from the function switch to CR3 clipper stage and mixed with the sync from TR8 to form the complete video signal. The signal is divided down by R78 and R79 to the diode modulator CR9. The RF channel oscillator TR19 frequency is controlled by L1 and C55 through C59 as selected by the front panel channel switch S4. The resultant RF energy is coupled through C54 to the diode modulator CR9. The video signal varies the diode conduction, changing its impedance to the RF signal, causing a modulated RF signal to be fed to the output cable for injection into the TV receiver.

The power supply is a transformer isolated full wave capacitive input type with double regulation for the counter stages. The D.C. voltage from the rectifiers CR6 and CR7 is dropped by R69 to a +25 volts supply for the trigger amp. R70 and zener CR11 further drop the voltage to a regulated 12 volts for the color oscillator and shaper stage and RF oscillator. The regulated 12 volt supply is further regulated by zener diode CR10 and pass transistor TR9 to a positive 7.4 volts for all other circuits in the generator.

The heater R68 with the indicator light 11 across it is controlled by the thermostat TH1. Resistors R65 and R66 in series with the thermostat are physically located on top. The heat caused by these resistors as well as the surrounding temperature control the opening and closing of the element and hence the turn on and off of the heating element R68.

TROUBLE CHART

SYMPTOM	PROBABLE CAUSE	CORRECTIVE MEASURE
No color bars ------	3.56 MHz crystal TR10 or CR3	Check transistor and diode. Replace crystal.
Color but no bars.	TR11, C28, C31	Check transistor. Check C18 and C31 for open.
Have RF but weak or no modulation.	CR8, TR8, C18	Check transistor and diode. Check C28 for open or short.
No RF.	TR19, CR9	Check transistor and diode.
No vertical bars or dots.	CR4	Check for open.
No vertical sync.	TR6, T3, TR8	Check transistors and diode. Check T3 with ohmmeter.
No vertical or horizontal sync.	TR8, C18	Check transistor. Check C28 for open.
No horizontal lines. Horizontal lines cut off before end of raster.	TR5, CR1, C10, C11	Check transistor. Check for open or off valve capacitors
Single vertical line inoperative.	TR12, TR13, TR14	Check transistors
Single vertical line goes off screen to the right.	R46 out of adjustment	Check adjustment
Single horizontal line inoperative	TR15, TR16, TR17	Check transistors
Single horizontal line goes off bottom of screen	R53 out of Adjustment	Check adjustment
Sound carrier inoperative	TR18, S2 4.5 MHz crystal	Check transistor, crystal, check switch for open
Heater apparently not working	II, TH1, weather	Check indicator, check thermostat (a small sliver of ice touched to metal sensor should make thermostat close) weather to hot.

SERVICE AND WARRANTY

You have just purchased one of the finest color bar generators on the market today. The CG159 Color King has been inspected and tested twice at the factory to insure the best quality instrument to you. If something should happen, the Color King is covered by a standard 90 day warranty as explained on the warranty policy enclosed with your instrument.

For the best service on out of warranty work, send the Color King directly to the factory service department. Be sure to state the nature of your problem to insure faster service.

If you wish to repair your own Color King, we have included a schematic, parts list, and trouble chart. Any of these parts may be ordered directly from the factory service department.

We reserve the right to examine defective components before an in warranty replacement part is issued.

THE IDEA PEOPLE

SENCORE, INC.

3200 SENCORE DRIVE, SIOUX FALLS, FALLS, SOUTH DAKOTA 57107

CG159 COLOR KING III

SCHEMATIC

AND

PARTS LIST

SENCORE
NO. 1 MANUFACTURER OF ELECTRONIC MAINTENANCE EQUIPMENT
3200 SENCORE DRIVE, SIOUX FALLS, SOUTH DAKOTA 57107

FORM 599

CG159 PARTS LIST

REFERENCE	DESCRIPTION	PART NO.	PRICE
CONTROLS			
R7, 8, 9	5K 30% Vert Mt. P.C. Pot	15C7-14	.75
R11, 13, 22	2K 30% Tab Mt. Pot	15C3-23	1.50
R20	25K 30% Vert Mt. P.C. Pot	15C7-12	.75
R36	2K 30% Panel Mt. Linear	15C1-11	1.50
R46, 53	1.2 Meg 30% Vert. P.C. Pot	15C7-8	.75
R48, 58	160K 30% Panel Mt. Linear	15C1-21	1.50
CAPACITORS			
C1, 2, 3, 18	10ufd @15VDC Lytic	24G120	.75
C8	3900 pf 5% Poly	24G142	.50
C12, 37, 38	.1ufd 10% Mylar	25G156	.50
C15	1.0 ufd 5% Mylar	24G160	1.00
C16	.022 ufd 10% Mylar	24G195	.50
C21	100 ufd @15V Lytic	24G118	1.00
C24	5-50 pf P.C. Mt. trimmer	24G47A	.65
C32, 55, 56 57, 58, 59	5-50 pf tab. mt. trimmer	24G205	.65
C35	560 pf 5% Poly	24G116	.50
C41	.003 ufd 10% Poly	24G56	.50
C42	.22 ufd 10% Mylar	24G168	.50
C43	.001 ufd 5% Poly	24G188	.50
C47	250-100-100 uf Lytic	24G169	1.75
TRANSISTORS AND DIODES			
TR1, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 16, 17, 18	Transistor, 2N5172	19C4-1	.50
TR2, 11, 13 14	Transistor 2N4248	19C14-1	.75
TR19	Transistor, 2N5227	19C16-1	.75
CR1, 2, 3, 8, 9	Diode, 1N34A	50C3-1	.50
CR 4, 5	Diode, 1N695	50C3-2	.50
CR 6, 7	Diode, Rectifier .5A @400 PIV	16S10	1.00
CR10	Diode, Zener 8.2V	50C4-2	1.25
CR11	Diode, Zener 12V	50C4-3	1.25
MISCELLANEOUS			
R68	Heater rope, 25W 8" long	14A61-2	1.25
T 1, 2, 3	Miniture Osc Xfmr.	46A51	1.50
TH1	Thermostat, 80° - 110° F	41A1-B	1.00
T4	Power Transformer	28B27	3.95
S1, 2	slide switch, SPST	25G4A	.50
S3	Pattern Selector switch	25A95	2.75
S4	Channel Selector switch	25A96B	1.95
	188.8 KHz crystal	47G17	
	3.56 MHz crystal	47G3	
	4.5 MHz crystal	47G2	

(PRICES SUBJECT TO CHANGE WITHOUT NOTICE)